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(54) **HOT DIE FORMING ASSEMBLY AND METHOD OF MAKING A HEAT TREATED PART**

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CPC **B21D 22/02** (2013.01); **B21D 22/022** (2013.01); **B21D 37/16** (2013.01); **C21D 1/673** (2013.01); **C21D 2221/00** (2013.01)

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,294,597 A 12/1966 Kuchera
2006/0185774 A1 8/2006 Nishibata et al.
(Continued)

FOREIGN PATENT DOCUMENTS

DE WO 2012010418 A1 * 1/2012 B21D 22/06
GB 1490535 11/1977
WO 2011160209 A1 12/2011

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(57) **ABSTRACT**

A method of making a part is provided. A blank is loaded into a die assembly having a pair of shoes with forming pieces attached thereto and compressible members sandwiched between the shoes and the forming pieces. The die is closed about the blank to deform the blank into a part. The die is then opened by a predetermined distance while at least one of the compressible members deforms elastically to maintain contact between at least one of the forming pieces and the part. Less than the entire surface of the part is then conductively cooled through the at least one forming piece to provide a predetermined portion of the part with a predetermined microstructure.

11 Claims, 6 Drawing Sheets

